

**Lower Passaic River, Lower Eight-Mile Focused Feasibility Study**  
**Sediment Transport, Organic Carbon and Contaminant Fate and Transport Model**  
**Charge to Peer Reviewers**

The peer reviewers are charged with reviewing a modeling tool developed for the Focused Feasibility Study (FFS) of the Lower Eight Miles of the Lower Passaic River. The modeling tool is described in Appendix B of the FFS (the other appendices contain other supporting analyses for the FFS).

**Background**

The Focused Feasibility Study Area (FFS Study Area) is the lower eight miles of the Lower Passaic River in northeastern New Jersey (NJ), from the river's confluence with Newark Bay at River Mile (RM) 0 to RM8.3 near the border between the City of Newark and Belleville Township (Figure 1-1). The FFS Study Area is part of the Lower Passaic River Study Area (LPRSA), which is the 17-mile, tidal portion of the Passaic River, from Dundee Dam (RM17.4) to the confluence with Newark Bay (RM0), and its tributaries. During a comprehensive study of the 17-mile LPRSA, the sediments of the FFS Study Area were found to be a major source of contamination to the rest of the Lower Passaic River and Newark Bay. Therefore, the United States Environmental Protection Agency (USEPA) completed a Focused Feasibility Study (FFS) to evaluate taking action to address those sediments, while the comprehensive study of the 17-mile LPRSA is on-going.

The Lower Passaic River (LPR) is a partially-stratified estuary that is connected to the NY/NJ Harbor Estuary through Newark Bay. The LPR has an authorized navigation channel from RM0-15.5, which was constructed at the end of the 19<sup>th</sup> century, then sporadically maintained through the 1950s above RM2 and through 1983 below RM2. As maintenance dredging was declining, industries along the river were growing and disposing of their wastewaters in the LPR. The coincidence of chemical disposal in the river, along with the filling-in of the navigation channel, created an ideal situation for the accumulation of contaminated sediments in the LPR. LPR sediments have a number of contaminants at levels that cause risks and hazards to human and ecological health ("contaminants of concern" or COCs) [see table below]. Sampling from 1995 to 2012 has shown that those high concentrations in surface sediments have not declined over the last 15 years (Figures<sup>1</sup> 4-8, 4-15).

---

<sup>1</sup> Figures are taken from FFS reports, so may not be numbered sequentially for this document.

### FFS Study Area Surface Sediment Concentrations of the Contaminants of Concern (COCs)

Surface Sediments, 0-6 inches	Unit <sup>a</sup>	Frequency of Detection	Minimum	Maximum	Mean	Median
2,3,7,8-TCDD	pg/g	291 / 293	0.09	13,500	597	276
Total TCDD	pg/g	239 / 240	2.2	13,300 <sup>b</sup>	733	394
Total PCBs	ug/kg	285 / 286	0.1	17,200	1,267	971
Total DDx	ug/kg	289 / 289	1.9	10,229	250	99.6
Dieldrin	ug/kg	198 / 283	0.01	152	12.6	5.5
Chlordane	ug/kg	272 / 272	0.05	254	34.9	26.1
Total PAHs	mg/kg	289 / 289	0.21	2,806	46.9	29.9
Mercury	mg/kg	287 / 295	0.05	13.4	2.5	2.3
Copper	mg/kg	298 / 298	11.5	2,470	182	173
Lead	mg/kg	292 / 292	4.4	763	257	242

Notes:

Based on 1995 – 2010 data.

<sup>a</sup>pg/g = picograms per gram or parts per trillion (ppt); ug/kg = micrograms per kilogram or parts per billion (ppb); mg/kg = milligrams per kilogram or parts per million (ppm).

<sup>b</sup>This value is based on 1995 data reported by Tierra Solutions Inc. The maximum concentration of Total TCDD should be higher than that of 2,3,7,8-TCDD. Although the maximum concentration of the Total TCDD is lower than that of 2,3,7,8-TCDD, this value is within measurement errors.

The LPR cross-sectional area declines steadily from RM0 to RM17.4, with a pronounced constriction at RM8.3. At that location, a change in sediment texture is also observed. The river bed below RM8.3 is dominated by silt material with pockets of silt and sand mixtures, while above RM8.3, the bed is characterized by coarser sediments with pockets of silt, often outside the channel. About 85 percent of the silt surface area in the LPR is located below RM8.3, and by volume, about 90 percent of silts in the LPR are located below RM8.3. Surface sediment sampling results show that there is no trend in surface sediment concentrations with river mile in RM2 to RM12 (Figures 4-3, 4-12, 4-17b, 4-32b, 4-47b).

To address the persistently elevated and wide-spread COC concentrations in FFS Study Area sediments that are causing unacceptable risks and health hazards, the FFS evaluates the following four remedial alternatives:

- 1) No Action (also called “Monitored Natural Recovery” or MNR in the modeling reports)
- 2) Deep Dredging with Backfill involves dredging all contaminated fine-grained sediments throughout the FFS Study Area and placing two feet of sand backfill. It results in the restoration of the authorized navigation channel in RM0-8.3.

- 3) Capping with Dredging for Flooding and Navigation (also called “Full Capping” in the modeling reports) includes dredging of enough fine-grained sediment so that an engineered sand cap can be placed over the FFS Study Area without causing additional flooding and to allow for a navigation channel between RM0.0 and RM2.2.
- 4) Focused Capping with Dredging for Flooding includes dredging of fine-grained sediments in selected portions of the FFS Study Area (about one third of the FFS Study Area surface) with the highest gross and net fluxes of COPCs and COPECs to a depth of 2.5 feet so that an engineered sand cap can be placed over those portions dredged without causing additional flooding. It does not include construction of a navigation channel.

### **Purpose and Objectives of the Modeling**

Sediment transport, organic carbon and contaminant fate and transport modeling of the LPR were performed to provide one of the tools used in comparative analyses of the four remedial alternatives being evaluated in the FFS. Sediment transport results provided input to organic carbon and contaminant fate and transport models. The objective of the sediment transport modeling was to develop a mathematical representation of the processes affecting sediment transport behavior, so that simulated sediment transport results could be used to assess the transport of sorbed contaminants in the fate and transport modeling. The objective of the organic carbon and contaminant fate and transport modeling was to develop a mathematical representation of the processes affecting contaminant fate and transport behavior of dissolved and sorbed contaminants based on the associated sediment transport results. The models could then be used to assess the effect that implementation of the four remedial alternatives would have on future surface sediment concentrations and their associated risks and health hazards.

### **Peer Review**

The sediment transport, organic carbon and contaminant fate and transport models for the LPR were based on an existing, peer reviewed model of the NY/NJ Harbor Estuary developed by the Contamination Assessment and Reduction Program (CARP). The CARP model was modified to be more applicable to conditions in the LPR. The peer reviewers are charged with determining whether the LPR-specific modifications to the CARP model have produced a tool that is adequate for USEPA to use in the FFS to compare the relative effects that implementation of each of the four remedial alternatives would have on future surface sediment concentrations.

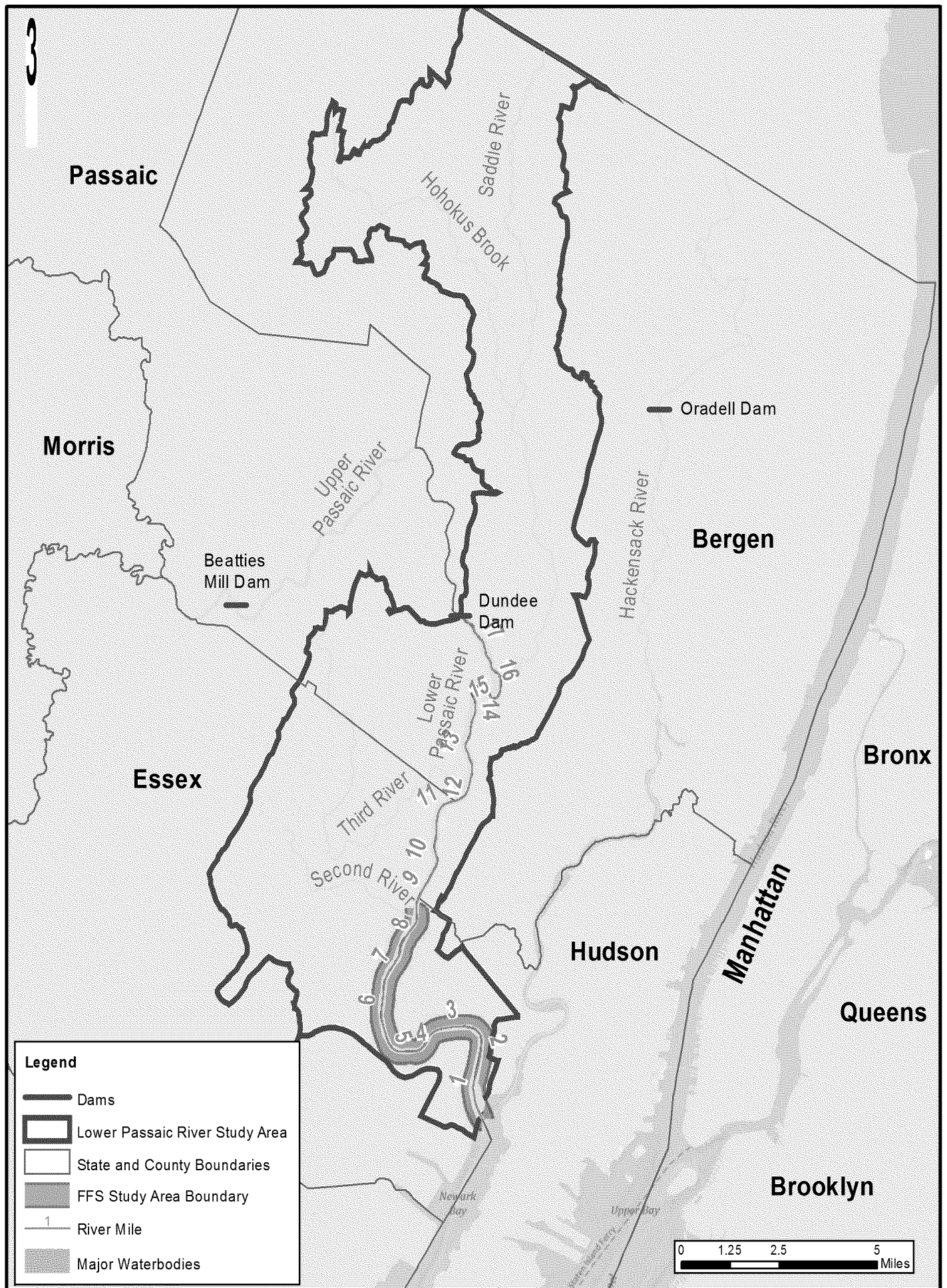
The peer reviewers are tasked with reviewing the following documents that are appendices to the FFS: Lower Passaic River Sediment Transport Model Report, Draft (Appendix B2) and Lower

Passaic River Contaminant Fate and Transport Model Report, Draft (Appendix B3) [both drafts dated January 31, 2013].

### *Reviewer Charge Questions*

The peer reviewers are also tasked with providing input on the following questions, with full explanations supporting their conclusions:

1. Are the physical, biological and chemical processes represented in the model adequate for describing sediment transport, organic carbon and contaminant fate and transport for the LPR, with particular focus on the FFS Study Area?
2. Have the appropriate data sets been properly and adequately used to set up the model input parameters and define forcing functions and initial conditions for the sediment transport, organic carbon and contaminant fate and transport models?
3. Does the model adequately represent the spatial and temporal distributions of the COCs in the water column and sediment bed for USEPA to use it as a tool to compare the relative effects that implementing each remedial alternative will have on FFS Study Area surface sediment quality?
4. Does the model adequately account for the contributions of COC sources that may re-contaminate FFS Study Area sediments during and after implementation of each remedial alternative?
5. Does the model adequately account for the effect of extreme storm events contributing to the resuspension and redistribution of contaminated sediments for USEPA to use it as one tool to compare the effects that implementing each of the four remedial alternatives will have on FFS Study Area sediment COC concentrations?



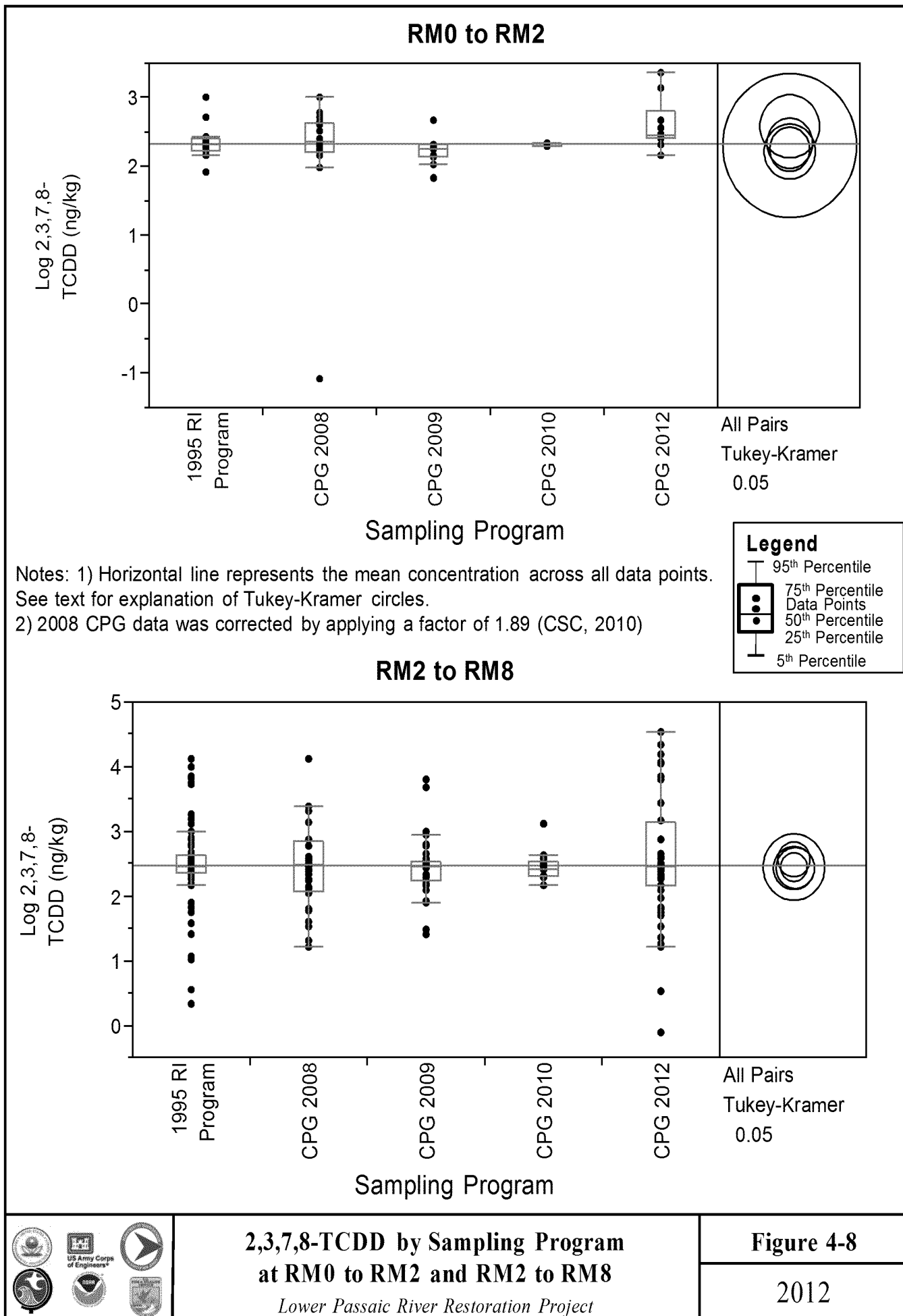
## FFS Study Area Location Map

Lower Passaic River Restoration Project

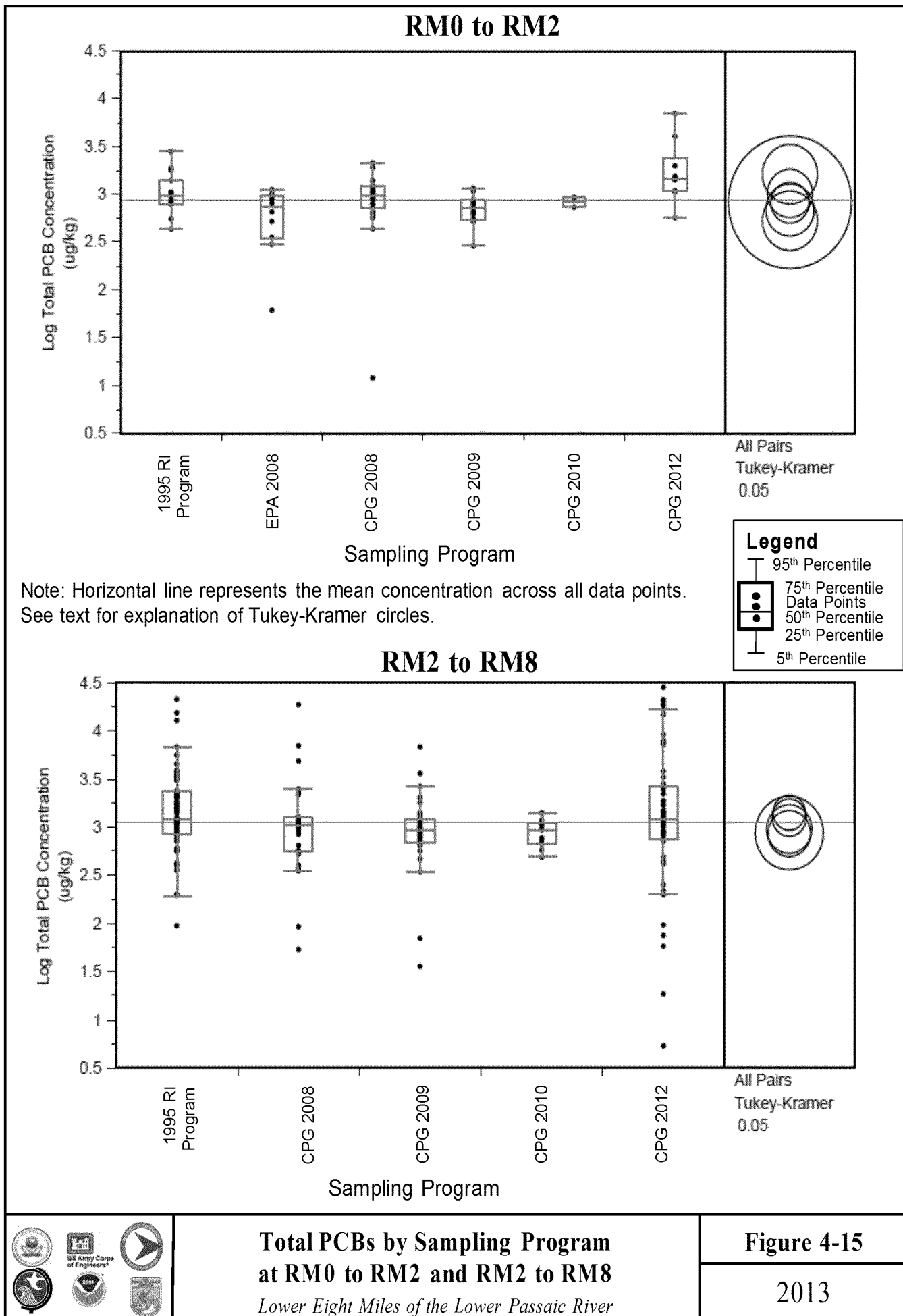
Figure 1-1

2012

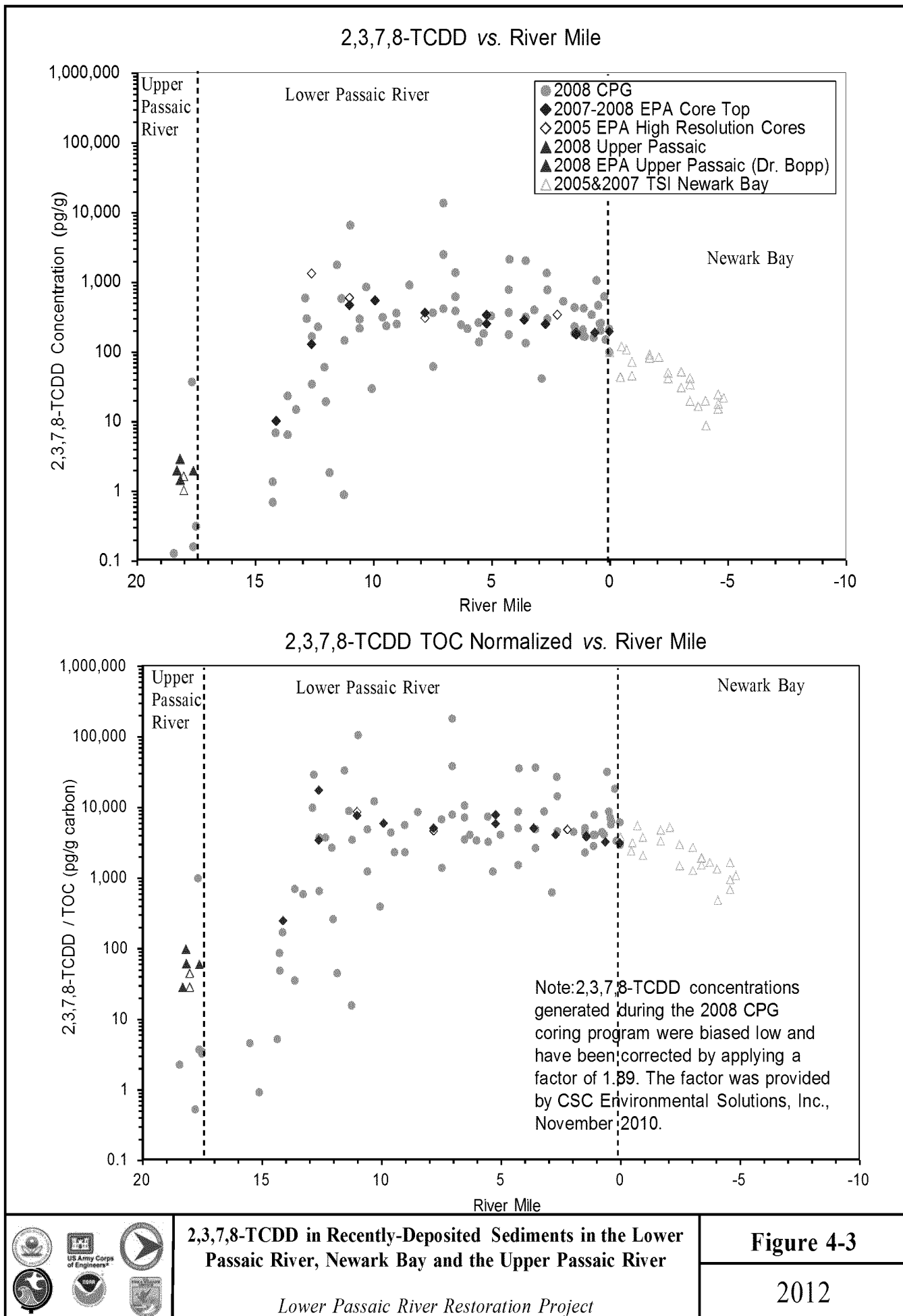
Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.



Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.

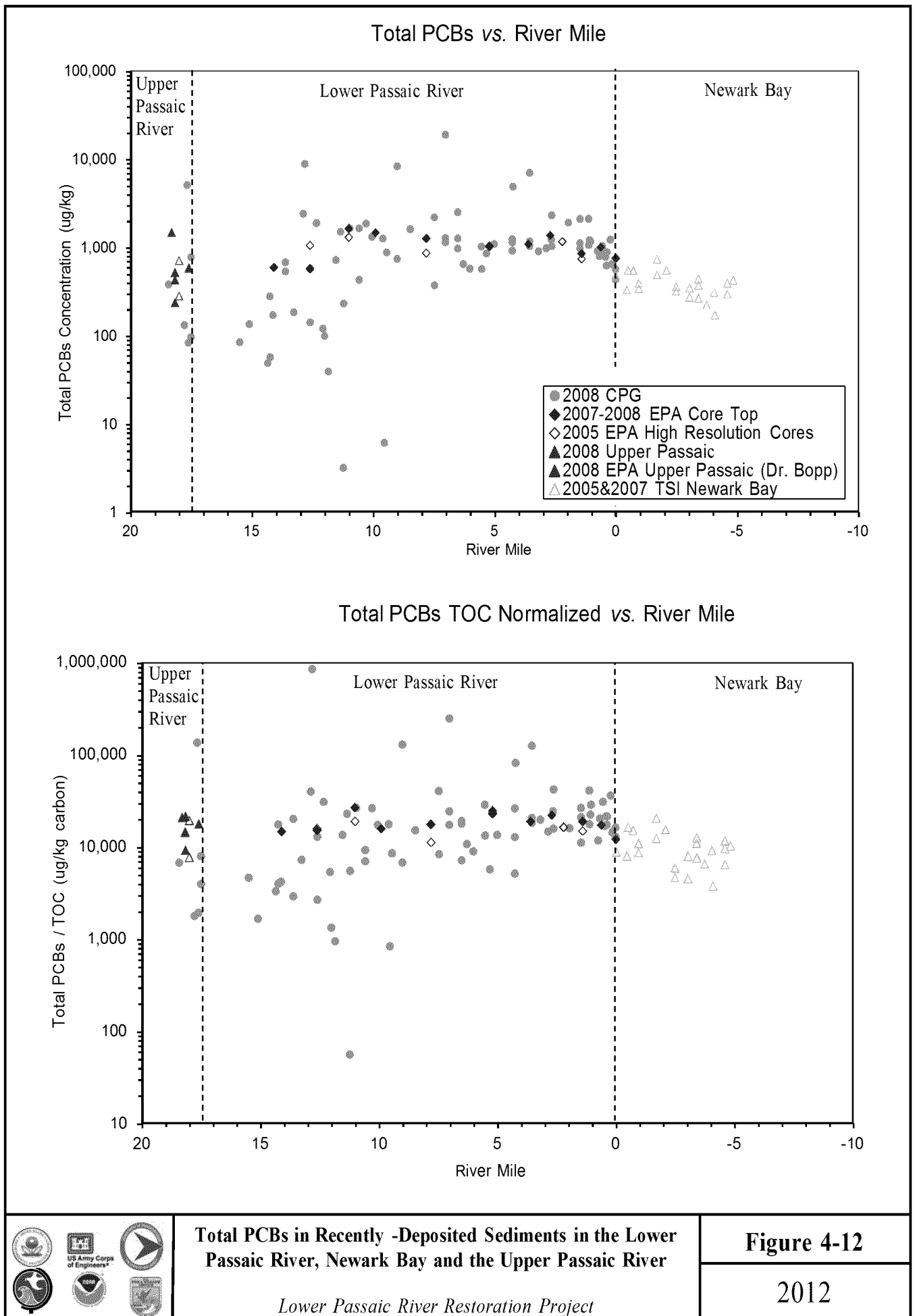


Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.

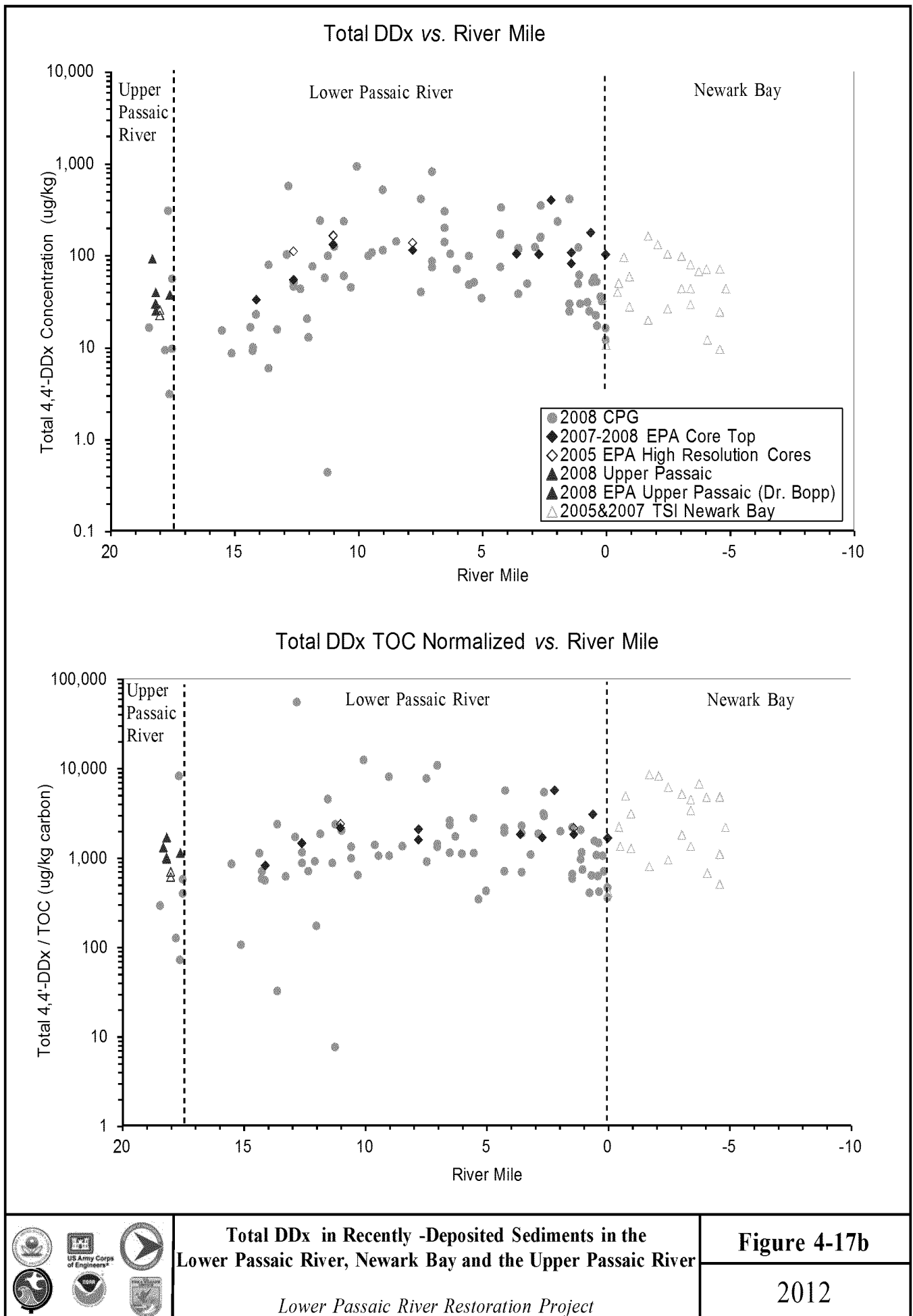


Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.

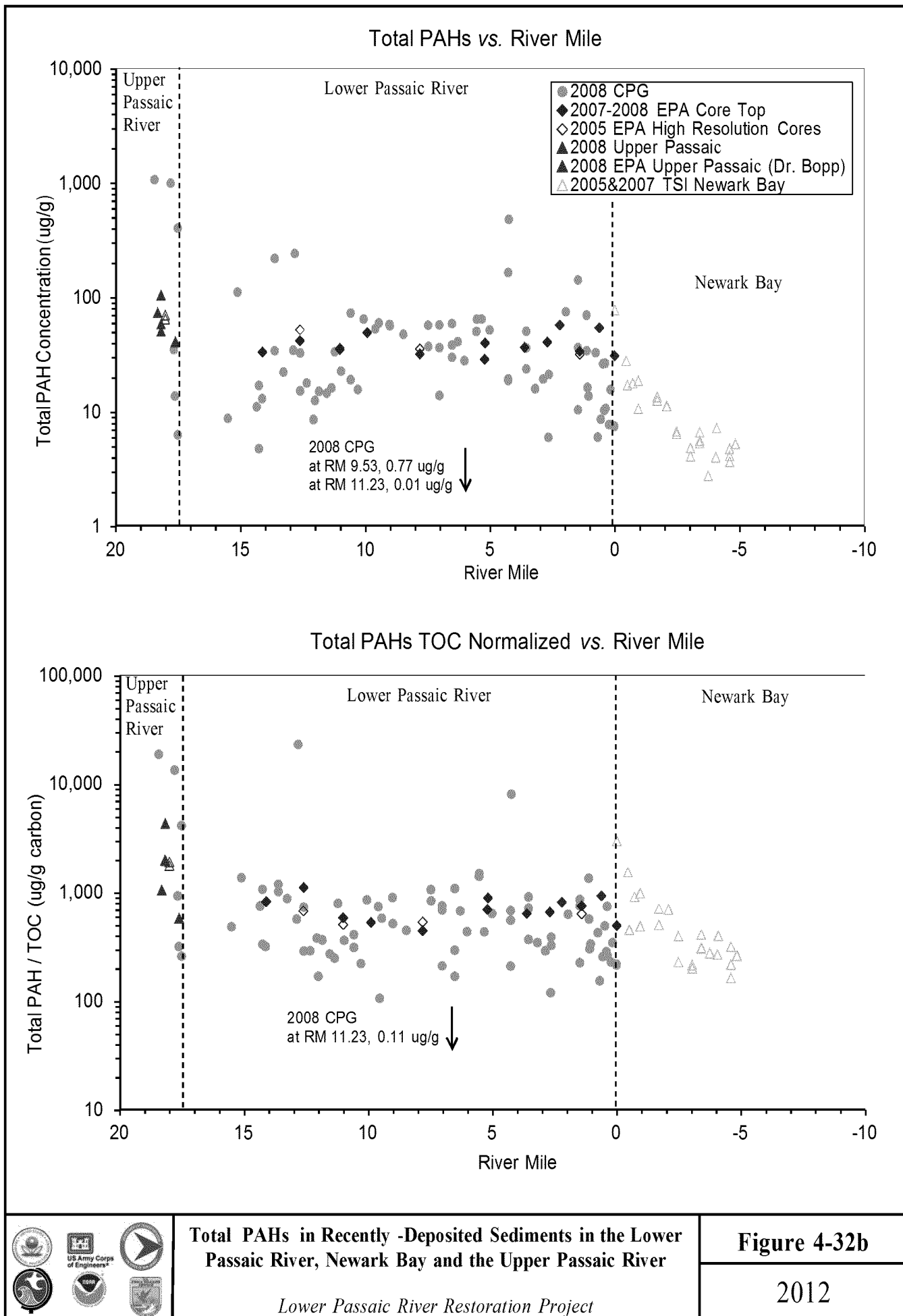




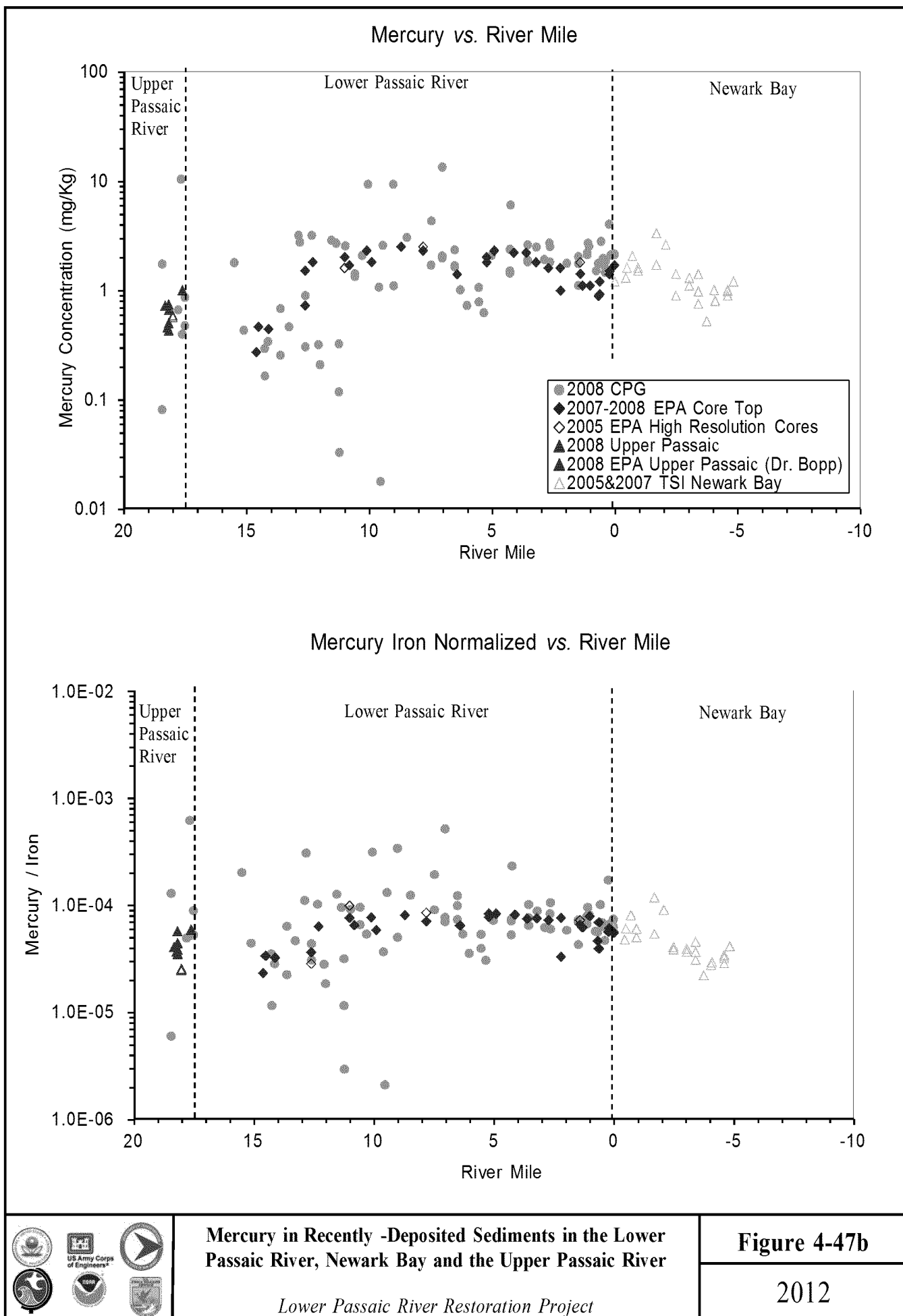
Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.



Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.



Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.



Source: Remedial Investigation Report for the Focused Feasibility Study, July 2012.